System 5 Installation Guide

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Chapter 1: Introduction

System 5 is an elaborately featured digital audio mixing system that can be configured to meet the requirements of large-scale film production, on-air broadcast, post-production, and music.

System 5 features and options include:

- Scalable control surface with application-specific controls, such as dual joysticks with a film monitor panel
- Scalable DSP mix engine
- Flexible I/O system
- Integrated MADI router
- Serial machine control interface
- GPIO

System Requirements and Compatibility

Avid can only assure compatibility and provide support for hardware and software it has tested and approved.

For complete system requirements and a list of qualified computers, operating systems, hard drives, and third-party devices, visit:
www.avid.com/compatibility

About This Guide

This guide provides a basic overview of System 5 features and functionality.

For complete instructions on connecting and configuring your system, see the *System 5 Installation Guide*.

Conventions Used in This Guide

All of our guides use the following conventions to indicate menu choices and key commands:

Convention	Action
File > Save	Choose Save from the File menu
Control+N	Hold down the Control key and press the N key
Control-click	Hold down the Control key and click the mouse button
Right-click	Click with the right mouse button

The names of Commands, Options, and Settings that appear on-screen are in a different font.

The following symbols are used to highlight important information:

User Tips are helpful hints for getting the most from your system.

Important Notices include information that could affect your data or the performance of your system.

Shortcuts show you useful keyboard or mouse shortcuts.

Cross References point to related sections in this guide and other Avid guides.

About www.avid.com

The Avid website (www.avid.com) is your best online source for information to help you get the most out of your system. The following are just a few of the services and features available.

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Chapter 2: System 5 Overview

This chapter provides a basic overview of the System 5 theory of operation, I/O solutions, and system requirements.

Chapter 3, "System 5 Console" presents the console in detail, including physical and environmental specifications.

Chapter 4, "Connecting System Components" illustrates how to interconnect system modules and components.

Theory of Operation

The primary components of System 5 are the DF66 or DF70 SuperCore mix engine, control surface modules, the SC264 System Computer, and the CO600 MADI Changeover Switch (used in broadcast redundancy configurations). These devices, along with TCP/IP-controlled devices such as the Modular I/O Remote Preamps, communicate via a 100 Base-T star network.

The SC264 contains the GPIO and serial machine control interface. Secondary peripheral devices, such as the ML530 Mic-Line Interface and the MC524 Monitor Interface, connect to the SC264 System Computer and communicate via the System 5 TCC serial protocol. All Avid I/O devices interface via MADI and connect directly to the DF66 or DF70 SuperCore, or to the CO600 MADI Changeover Switch.

Digital Signal Processing

The DF66 or DF70 SuperCore performs all System 5 audio processing and routing (Dynamics, EQ, mix busses, aux sends, and monitor busses). The DF66 can be fitted with up to six SP663 DSP Line cards, each of which provides four MADI I/Os. For systems that demand more DSP, the DF70 has eight cards that supports up to 454 channels at 48 kHz or 222 channels at 96 kHz. The actual DSP is allocated using factory-supplied Mixer Model files that provide different numbers of busses and channels.

SuperCores with six or more SP663 Line Cards require Avantech modules with 1 GB RAM.

The number of SP663 Line cards required in a system depends on the number of *logical channels* desired: a mono input uses one logical channel, a stereo input uses two, and a 7.1 input uses eight.

The following devices can be used for non-redundant DSP configurations:

- SC264D (1–2 cards)
- SC264 + DF66 (1–6 cards)
- SC264 + DF70 (8 cards)

In broadcast redundancy configurations, two identical DF66s operate in parallel, one as primary and the other as backup. Each connects to the CO600 MADI Changeover Switch, which monitors the performance of both. If the primary DF66 fails, the backup is automatically placed online.

The following devices can be used for redundant DSP configurations:

- SC264D + DF66 + CO600 (1–2 cards)
- SC264 + DF66x2 + CO600 (1–6 cards)

All DSP card versions must run the most current firmware. See instructions with the update software.

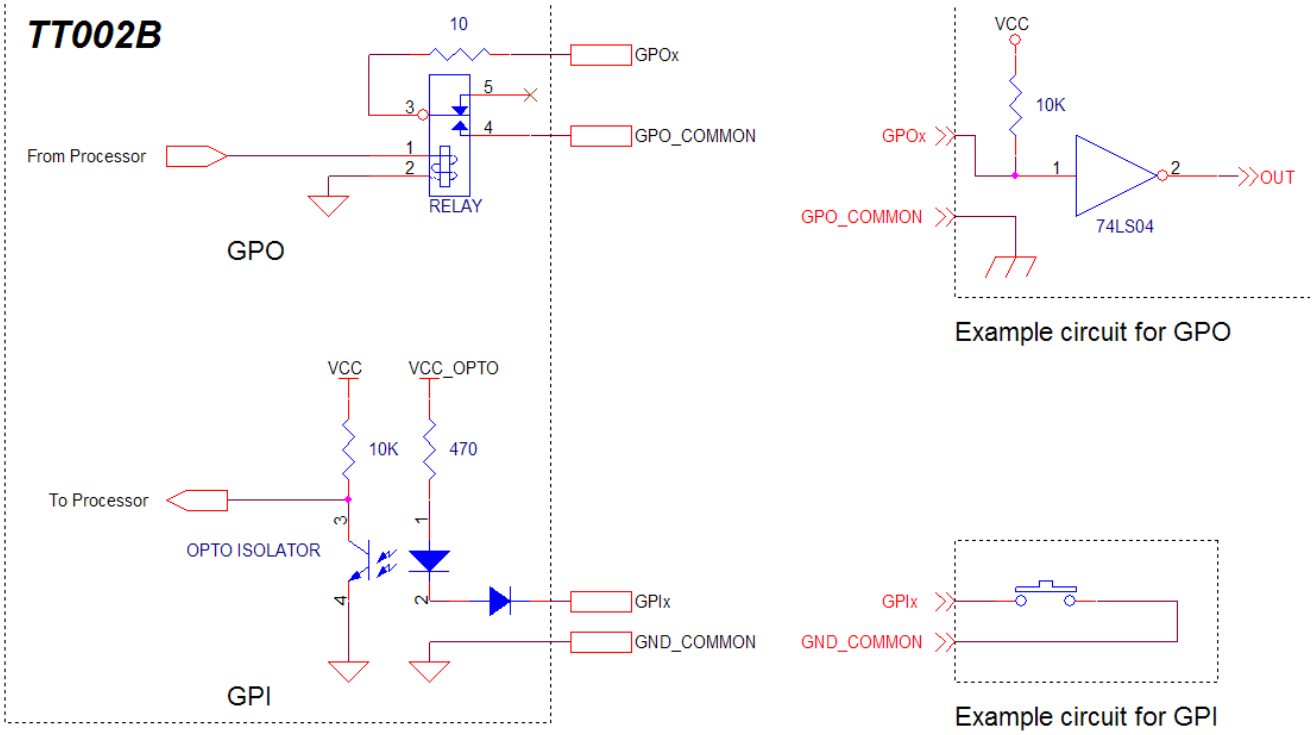
TT002B

The TT002B is a single-port, RS422 (Sony 9-pin) USB device and MMC machine controller that ships with all System Computers. The TT002B locks to a machine and reads LTC more quickly than the devices it replaced (TT002, TT007, MOTU Midi Interface, and GP132). To control more than one machine, a Sound Master, Colin Broad RM6, or similar device is required.

The System 5 software can auto-sense the TT002B. The setup options are done from the Machines page on the CM401T, and the System Preferences Page. The timecode source, frame rate, track arming length, and fast forward/rewind speeds can all be set from the System Preferences page. The CM401T TFT displays the selected frame count and incoming frame rate.

A TT003 machine controller is available for dual-operator System 5 configurations. It is physically different from the TT002 and requires different firmware. An additional USB port is provided to connect the two System Computers.

The following diagram shows the TT002B's GPI circuit.



TT002B GPI input and output circuit diagrams

The TT002 is not a synchronizer.

External 37 way Female D-Type	Internal board header	
1	1	*GPI 1*
20	2	*GPO 1*
2	3	*GPI 2*
21	4	*GPO 2*
3	5	*GPI 3*
22	6	*GPO 3*
4	7	*GPI 4*
23	8	*GPO 4*
5	9	*GPI 5*
24	10	*GPO 5*
6	11	*GPI 6*
25	12	*GPO 6*
7	13	*GPI 7*
26	14	*GPO 7*
8	15	*GPI 8*
27	16	*GPO 8*
9	17	*GPI 9*
28	18	*GPO 9*
10	19	*GPI 10*
29	20	*GPO 10*
11	21	*GPI 11*
30	22	*GPO 11*
12	23	*GPI 12*
31	24	*GPO 12*
13	25	*GPI 13*
32	26	*GPO 13*
14	27	*GPI 14*
33	28	*GPO 14*
15	29	*GPI 15*
34	30	*GPO 15*
16	31	*GPI 16*
35	32	*GPO 16*
17	33	*GND(for GPI1~16)*
36	34	*COM1 (for GPO1~4)*
18	35	*COM2 (for GPO5~8)*
37	36	*COM3 (for GPO9~12)*
19	37	*COM4 (for GPO13~16)*

External 37 way Female D-Type	Internal board header	
1	1	GPI 17
20	2	GPO 17
2	3	GPI 18
21	4	GPO 18
3	5	GPI 19
22	6	GPO 19
4	7	GPI 20
23	8	GPO 20
5	9	GPI 21
24	10	GPO 21
6	11	GPI 22
25	12	GPO 22
7	13	GPI 23
26	14	GPO 23
8	15	GPI 24
27	16	GPO 24
9	17	GPI 25
28	18	GPO 25
10	19	GPI 26
29	20	GPO 26
11	21	GPI 27
30	22	GPO 27
12	23	GPI 28
31	24	GPO 28
13	25	GPI 29
32	26	GPO 29
14	27	GPI 30
33	28	GPO 30
15	29	GPI 31
34	30	GPO 31
16	31	GPI 32
35	32	GPO 32
17	33	*GND(for GPI17~32)*
36	34	*COM1 (for GPO17~20)*
18	35	*COM2 (for GPO21~24)*
37	36	*COM3 (for GPO25~28)*
19	37	*COM4 (for GPO29~32)*

TT002B GPI input and output wiring chart

Control Surface

Each control surface must include one CM401T Master Module and at least one CM408T Eight-Fader Module. The System 5 control surface modules are listed in the table below. Depending on the system configuration, the surface modules may have redundant PSUs.

System 5 Control Surface Modules

CM401T	Master control module with configuration interface
CM402T	Expanded channel module with eight faders
CM403	Dual joystick and film monitor panel
CM408T	Eight-fader module
CM409F*	Blank section, same size as the CM408T
CM409H*	Half-width blank section
CM409HTP	Half-width section with a trackball panner
CM411	VGA input module with optional dual joysticks

Facilities often install a larger console frame than is required for the initial surface module configuration. This can support future expansion or fulfill physical requirements for console access. Blank sections such as the CM409F and CM409H can fill otherwise empty spaces in the frame.

Sources

A System 5 fader can control one source at a time. Each source may be assigned a variety of formats, from mono to 7.1, and requires one or more logical channels. For example, a mono source requires one channel, a stereo source requires two, and a 7.1-channel source requires eight. This means that a fader assigned to a 7.1-channel source is controlling eight logical channels simultaneously.

Physical Faders

Each CM408T module has eight fader strips. Two sources in any format can be assigned to a fader strip, but only one can be controlled at a time. The fader strip's Swap button switches between the two sources: When the Swap button is lit, the fader controls the Swap layer, otherwise it controls the Main layer.

Layouts

Source assignments to console faders can be saved using a *Layout*, which can map the entire console or just a selected number of faders. Layouts can be named, stored, and recalled to instantly remap the console surface. Recalling a Layout that does not include all faders remaps only those in the Layout.

Consider two Layouts using a console with one CM408T with eight physical faders:

- Layout 1 could recall 16 stereo sources assigned to the faders (eight Main, eight Swap), resulting in 32 logical channels.
- Layout 2 could recall 16 5.1-channel sources assigned to the faders (eight Main, eight Swap), resulting in 96 logical channels.

System Configuration

The SC264 System Computer runs the eMix software, provides the primary console configuration interface, and performs file management functions. The computer also houses the TCC serial interface for monitor control, GPIO, and serial machine control.

DAW Control

The SC264 uses the Avid EUCON™ high-speed network protocol to communicate with DAWs via a 100 Base-T network switch. Using EUCON, the console can simultaneously control up to five DAWs, including Pro Tools, Nuendo, Logic Pro, and Pyramix.

EUCON network switch connection options include:

- SC264D using virtual Hybrid Pilot (Fusion only)
- PC254H Hybrid Pilot (S5, S5BP)

SNMP

SNMP monitoring is available in the DF66 and DF70 SuperCores and the CO600 MADI Changeover Switch. SNMP modules have battery back-up and an independent network connection.

Power

Most of the System 5 console components have dual power entry connectors for redundant power supplies. Avid recommends deriving power from two different sources to maximize failsafe capabilities. Connect one power supply to a UPS (Uninterruptible Power Supply) and the other to a clean technical power source. If a UPS is not used, the power supplies should be connected to separately protected, clean, technical power circuits.

Synchronization

Word Clock or AES Sync (DARS) may be used as the clock source required by many System 5 components, including the DF66/DF70 SuperCore, CO600 MADI Changeover Switch, and all MADI I/O. In addition, video sync is required for the serial machine control interface in the System Computer. Avid has tested several digital sync generators and distribution amplifiers and can supply these devices with the console. Contact Avid technical support for further information.

The following guidelines produce reliable synchronization:

- Word Clock/AES Sync is usually derived via a converter from the facility's master video sync reference. Never employ multiple video sync-to-sample clock conversions in a single system. Separately derived sample clocks may not be in-phase.
- Each distribution amplifier should be fed directly from the master clock source. This eliminates the timing differences between signal paths of different lengths.
- Never loop synchronization signals through multiple MADI converters. This can lead to cumulative timing errors and loss of sync for downstream devices if that converter powers down.

Illustrations in this guide show Word Clock, but AES Sync (DARS) may also be used.

I/O Solutions

Avid offers various I/O solutions, all employing MADI connections to the DF66/DF70/CO600. These include Avid stand-alone 2RU MADI converters as well as a flexible Modular I/O System (see page 12). It is also quite common to make MADI connections directly to DAWs and routers.

Analog I/O

The AM713 Analog-to-MADI Converter and MA703 MADI-to-Analog Converter are stand-alone 2RU units. The AM713 contains 26 analog inputs and one AES/SPDIF input with SRC (two channels). The MA703 contains 26 analog outputs and one AES/SPDIF output.

Microphone

The ML530 Mic-Line Interface contains 24 remote-controlled mic preamps. Audio outputs are fed to a dedicated AM713 Analog-to-MADI Converter for MADI connection to the DF66/DF70/CO600. The ML530 is controlled via the TCC serial protocol by the System Computer. Up to seven ML530s may be deployed in a system.

Digital I/O

The DM714 AES-to-MADI Converter and MD704 MADI-to-AES Converter are stand-alone 2RU units. The DM714 contains 13 AES inputs (26 channels) with SRC, and two analog inputs. The MD704 contains 13 AES and two analog outputs. Units are available with 110-Ω XLR or 75-Ω BNC connections.

Avid Modular I/O

Avid Modular I/O System 5 configurations consist of one or more 3RU frames with redundant PSUs that can be fitted with a variety of I/O modules. All signals to the console are converted to and from MADI. Depending on the configuration, a maximum signal density of 64 inputs and 64 outputs can be achieved on a single MADI I/O.

The Modular I/O system supports the following audio formats: remote-controlled preamp, line level analog, AES/EBU, and HD/SD embedder/de-embedder. Additional modules handle sync, MADI I/O, and remote-control interface.

Refer to the *Modular I/O Configuration Guide* for complete details.

The Modular I/O system includes the following modules:

Digital

- DD915 8ch AES I/O (110 Ω DSub) 1 slot
- DD916 8ch AES I/O (75 Ω BNC) 2 slots

Analog Line

- AD920 4ch Analog Input (XLR)
- DA921 4ch Analog Output (XLR)
- AD922 4ch Analog Input (D-sub)
- DA923 4ch Analog Output (D-sub)

Microphone Preamp

- AD914 4ch Mic Input (RJ-45)

De-embedder

The Modular I/O system can include a 16-channel de-embedder module that de-embeds audio from a video signal.

- HD944 16ch HD De-embedder (no embedder function) Video In/Thru, 1 slot, supports SMPTE299M HD standard

Dolby

These Dolby encoders and decoders use one slot. See the *Modular I/O Configuration Guide* for details.

- DE901 Dolby D/E Decoder
- DE911 Dolby E Encoder
- DE912 Dolby D/D+ Encoder

Format Conversion

The FC726 Format Converter is a bidirectional MADI converter, supplying 28 AES inputs (56 channels) with SRC and 28 AES outputs. I/O is divided into eight-channel banks to interface to multichannel devices, such as digital multitracks and DAWs. In addition to AES/EBU I/O, the FC726 supports direct connection to several third-party formats, including TDIF, SDIF-2, ADAT Optical, and MADI (via SRCs). AES/EBU outputs are always active even when using third-party formats.

Monitoring

The MC524 Monitor-Comms Interface provides the following monitoring features:

- Main (7.1), Alt 1 (5.1), and Alt 2 (stereo) control room speaker outputs
- SLS (7.1), and Cues 1-3 (each stereo) studio speaker outputs
- Two talkback and four listen mic preamps

A dedicated MA703 MADI-to-Analog Converter feeds audio to the MC524. The MA703 is connected to the DF66 MADI out 1, which is reserved for monitor outputs. The MC524 is connected to the System Computer and controlled via the Avid TCC serial protocol.

System Control Connections

Ethernet

All primary system components are connected via RJ-45 Ethernet through a 100 Base-T Ethernet switch. These devices include:

- SC264 System Computer
- CM401T Master Fader Module (console center section)
- CM402T Expanded Channel Module (console center section)
- CM403 Film and Joystick Panels
- CM408T Eight-channel Modules
- DF66 SuperCore
- DF70 SuperCore
- CO600 Changeover Switch
- Modular I/O Remote modules

Monitor, Trackball, and Keyboard

The System Computer provides master control for the entire system. Connect a monitor, trackball, and keyboard to this computer to control mixing, routing, and file management.

A KVM Extender is normally used to route these signals from the machine room to the control room through a single multi-pair cable built into the console Ethernet harness.

TCC Control

The System computer connects to the MC524 Monitor Interface and up to seven ML530 Mic-Line Interfaces via TCC connections.

Machine Control

The System Computer provides a 9-pin serial interface to connect to a serial device or synchronizer (Colin Broad RM6 or Soundmaster). A MIDI interface and timecode I/O are included on a separate 9-pin connector. A BNC video sync input is available for serial machine control reference.

GPI Control

The System Computer provides 32 GPI inputs and 32 GPI outputs on two 37-pin D-sub connectors.

Estimating System Requirements

This section helps estimate your system's installation requirements. Contact an Avid representative for an exact specification. Most of the studio details considered here are relevant to any digital mixing system.

The Mixer Model's relationship to the number of Line Cards is illustrated in the tables below. A Mixer Model consists of the attributes in a column. Note that the DF66 can have 1–6 Line Cards installed, while the DF70 always has eight.

System 5B (Broadcast) at 48 kHz

Cards	1	2	3	4	5	6	6
Channels	50	76	116	160	210	260	304
Mix	12	24	24	32	32	32	32
Group	8	16	24	24	24	24	24
Aux	16	20	24	24	24	24	24
Bus Processors	0	8	12	16	16	16	0
Solo	2	2	2	2	2	2	2
Mix Minus	1	1	1	1	1	1	1
Externals	16	24	24	32	32	32	32
Total Paths	105	171	227	291	341	391	419

System 5 (Music), System 5BP (Broadcast-Post) at 48 kHz

Cards	1	2	2	2	3	4	5	6	6
Channels	54	90	112	128	156	184	244	304	334
Mix	20	32	32	16	32	48	48	48	48
Group	8	8	8	24	8	8	8	8	8
Aux	8	16	16	2	16	24	24	24	24
Bus Processors	0	8	0	0	8	8	8	8	0
Solo	2	2	2	2	2	2	2	2	2
Mix Minus	0	0	0	0	0	0	0	0	0
Externals	16	24	24	6	24	32	32	32	32
Total Paths	108	180	194	178	246	306	366	426	448

System 5 (Music), System 5BP (Broadcast-Post) with DF70 at 48 kHz

Cards	8	8	8	8	8	8	8
Channels	424	454	404	362	344	380	312
Mix	48	48	48	64	96	64	48
Group	8	8	2	8	8	8	48
Aux	24	24	24	16	8	24	24
Bus Processors	8	0	48	64	48	24	48
Solo	2	2	2	2	2	2	2
Mix Minus	0	0	0	0	0	0	0
Externals	24	24	24	72	72	32	32
Total Paths	538	560	552	588	578	534	514

System 5 (Music), System 5BP (Broadcast-Post) with DF70 at 96 kHz

Cards	8	8	8	8
Channels	202	222	124	180
Mix	32	32	64	64
Group	8	8	8	24
Aux	16	12	16	24
Bus Processors	6	0	48	0
Solo	2	2	2	2
Mix Minus	0	0	0	0
Externals	16	16	16	16
Total Paths	282	292	278	310

System 5P (Post), System 5BP (Broadcast-Post) at 48 kHz

Cards	1	2	2	3	4	5	6	6	6
Channels	54	96	116	152	170	228	286	324	266
Mix	12	12	12	12	24	24	24	24	32
Group	16	24	24	32	48	48	48	48	48
Aux	12	16	16	16	24	24	24	24	24
Bus Processors	0	6	0	6	6	6	6	0	6
Solo	2	2	2	2	2	2	2	2	2
Mix Minus	0	0	0	0	0	0	0	0	0
Externals	16	24	24	24	32	32	32	32	32
Total Paths	112	180	194	244	306	364	422	454	410

System 5 (Post), System 5BP (Broadcast-Post) at 96 kHz

Cards	1	1	2	3	4	5	6	6	6	6
Channels	22	26	54	72	104	126	158	176	124	148
Mix	8	8	8	8	8	12	12	12	24	48
Group	8	2	8	16	16	24	24	24	24	8
Aux	8	6	8	8	8	12	12	12	24	16
Bus Processors	0	0	0	4	4	6	6	0	6	0
Solo	2	2	2	2	2	2	2	2	2	2
Mix Minus	0	0	0	0	0	0	0	0	0	0
Externals	8	8	8	8	8	16	16	16	16	8
Total Paths	56	52	88	121	150	198	230	242	220	230

Number of CM408T Eight-channel Sections

One installation may require a small, powerful console to control many inputs from a small number of faders. Another may trade console size for the power of accessing each input quickly without swapping channels or recalling a Layout. Specify enough physical faders to conveniently control the required number of inputs.

MADI I/O Components

The following tables summarize the I/O capabilities of Avid's MADI converters for System 5. The DF66 MADI I/O depends on the number of SP663 DSP cards installed. Each card provides four MADI I/Os for a maximum of 24 MADI inputs and 23 MADI outputs (MADI out 1 is reserved for the MA703/MC524 monitor connection).

For modular I/O, only mic, analog, AES, and embedder/de-embedder modules are shown. Refer to the *Modular I/O Configuration Guide* for more details on sync, MADI I/O, and remote control modules as well as general configuration requirements.

Avid Converters and Interfaces

Device	Size	Mic Inputs	Analog Inputs	AES Inputs	Analog Outputs	AES Outputs	Monitor Outputs
AM713 **Analog to MADI Converter**	19 in 3RU	–	26	1	–	–	–
MA703 **MADI to Analog Converter**	19 in 3RU	–	–	–	26	1	–
DM714 **AES to MADI Converter**	19 in 3RU	–	2	13	–	–	–
MD704 **MADI to AES Converter**	19 in 3RU	–	–	–	2	13	–
FC726 **Format Converter**	19 in 3RU	–	–	28	–	28	–
ML530 **Mic-Line Interface**	19 in 3RU	24	–	–	–	–	–
MC524 **Monitor Interface**	19 in 3RU	6	–	–	–	–	24

Avid Modular I/O Devices

Device	# of Slots	Mic Inputs	Analog Inputs	Analog Outputs	AES Inputs	Dolby In	Dolby Out	AES Outputs	Video In	Video Out	Video Thru
DE901 Dolby D/E Decoder	1	–	–	–	–	1	1	–	–	–	–
DE911 Dolby E Encoder	1	–	–	–	–	1	1	–	–	–	–
DE912 Dolby D/D+ Encoder	1	–	–	–	–	1	1	–	–	–	–
AD914 4ch Mic Input	1	4	–	–	–	–	–	–	–	–	–
DD915 8ch AES I/O (110 Ω)	1	–	–	–	4	–	–	4	–	–	–
DD916 8ch AES I/O (75 Ω)	2	–	–	–	4	–	–	4	–	–	–
AD920 4ch Analog Input	2	–	4	–	–	–	–	–	–	–	–
DA921 4ch Analog Output	2	–	–	4	–	–	–	–	–	–	–
AD922 4ch Analog Input	1	–	4	–	–	–	–	–	–	–	–
DA923 4ch Analog Output	1	–	–	4	–	–	–	–	–	–	–
HD944 16ch SDI-Demux (De-Embedder)	1	–	–	–	–	–	–	–	1	–	1

All AES I/O are shown as pairs with two channels per I/O.

System 5 Module and Component Summary

System 5's components are summarized in the table below.

System 5 Modules, Console, and Components

Component	Function	Number	Notes
CM401T Master Module	These two modules comprise the center section of the console. The CM402T offers eight additional channels.	1 required	CM401T includes TB Mic and expansion port to wire TB external switches.
CM402T Expanded Channel Module		optional	
CM403 Film/Post Module	Houses joystick panner and film monitor panels.	optional	Ethernet device
CM408T Eight-channel Module	Contains 8 physical faders that control two layers of 8 inputs.	1 required	Ethernet device
CM411 VGA Input Module	VGA flat display inside module; can be configured with joysticks.	optional	VGA display device with serial port option for joysticks.
CM409F Module	Full, blank console section.	optional	Serial device
CM409H Module	Blank half-width console section.	optional	Serial device
CM409HTP Track Panner Module	Half-width console section with trackball panner.	optional	Serial device
TT002B	Machine control Interface; GPIO controller; Housed in the SC264 System Computer.	required	Video sync recommended for 9-pin operation
MC524 Monitor Interface	Analog monitor output controller	1 required	TCC connection to Interface Pilot. 1 MA703 is required (standard).
ML530 Mic-Line Interface	24 remote-control mic preamps	7 max	1 AM713 is required per ML530.
SC264 System Computer	Master system computer configures DF66/DF70 and controls MC524, ML530, and integrated DAWs. Houses the TT002B machine and GPIO controller.	1 required	Ethernet device. Connects to control room display monitor (optionally CM411), keyboard, and trackball.
SC264D System Computer	Master system computer controls MC524, ML530, and integrated DAWs. Houses up to 2 DSP Line Cards, TT002 machine and GPIO controller.	1 required	Ethernet device. Connects to control room display monitor (optionally CM411), keyboard, and trackball.
DF66 SuperCore	Performs all system DSP; can contain up to 6 DSP cards	1 required (4 max)	Ethernet device. Requires digital sync reference.
DF70 SuperCore	Performs all system DSP with eight DSP line cards. Drives up to 454 channels at 48 kHz or 222 channels at 96 kHz (depends on Mixer Model)	optional (2 max)	Ethernet device. Requires digital sync reference.
CO600 Changeover Switch	MADI routing hub for Failover system	optional	Ethernet device
AM713 Analog to MADI Converter	Provides 24 Analog to MADI Converters, a dual-channel Aux Digital Input (AES/EBU or S/PDIF available), and 2 channels Aux Analog Input.	1 required for each ML530 specified.	Requires digital sync reference.
MA703 MADI to Analog Converter	Provides 24 MADI to Analog Converters, a dual-channel Aux Digital Output (AES/EBU or S/PDIF available), and 2 channels Aux Analog Output.	1 required for the MC524	Requires digital sync reference.

DM714 AES/EBU to MADI Converter	Provides 24 AES/EBU to MADI Converters, a dual-channel Aux Digital Input (AES/EBU or S/PDIF available), and 2 channels Aux Analog Input.	optional	Requires digital sync reference. Optional 75-Ω BNC AES/EBU connectors.
MD704 MADI to AES/EBU Converter	Provides 24 MADI to AES/EBU Converters, dual-channel Aux Digital Output (AES/EBU or S/PDIF available), and 2 channels Aux Analog Output.	optional	Requires digital sync reference. Optional 75-Ω BNC AES/EBU connectors.
FC726 Digital Format Converter	Provides 56 channels of format converted inputs and outputs (112 channels total). Supports MADI, AES/EBU, T-DIF, ADAT Optical, S-DIF2, ProDigi.	optional	Requires digital sync reference.
Modular I/O	Provides format conversion for up to 64 input and output channels. Supports MADI, AES/EBU, Analog, remote-control mic preamps, HD/SD embedders/de-embedders.	optional	Requires digital sync reference and Ethernet connection for remote mic preamps and 8-channel embedder/de embedder.

Chapter 3: System 5 Console

The System 5 Console consists of one CM401T Master Module and other optional components that include the CM402T Expanded Channel Module, the CM408T Eight Channel Module, the CM403 Film/Post Module, and the CM409HTP Track Panner Module.

Console Component Connections

Each console component has the following connections:

Power Connector (IEC) Accepts standard IEC power cord (provided). An auto-switching supply accepts voltages in the range 100–240 VAC, 50–60 Hz.

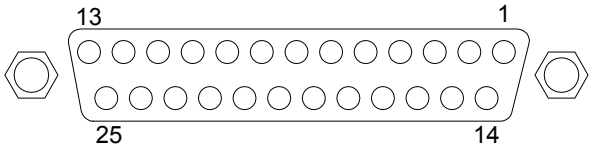
Network Port (RJ-45) Connects to EUCON Network Switch via RJ-45 through the console Ethernet harness (provided).

Expansion Port (DB-25) Active on the CM401T only. Connects optional, external talkback system (also available through the Events system). An optional 16-port BNC Bulkhead Panel supports access to the MADI ports of the DSP cards.

VGA Port (HD15D) For Avid internal use only.

Mouse and Keyboard Used only on the CM401T.

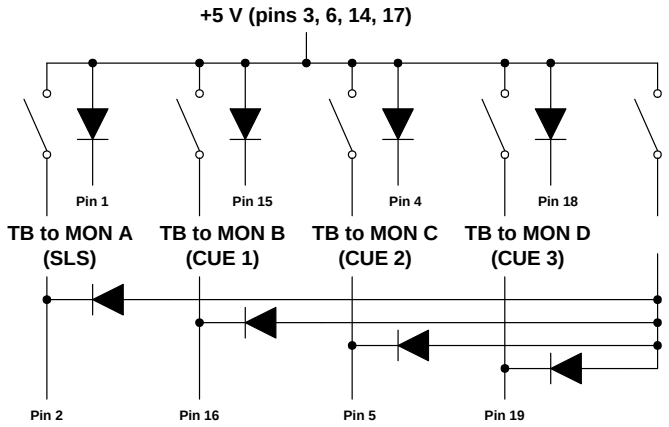
Serial Port Used to connect the Joysticks.



Pin #	Signal
1	LED 1 output (active low)
2	Switch 1 input (active high)
3	+5V
4	LED 3 output (active low)
5	Switch 3 input (active high)
6	+5V
7	LED 5 output (active low)
8	Switch 5 input (active high)
9	+5V
10	LED 7 output (active low)
11	Switch 7 input (active high)
12	+5V
13	+5V
14	+5V
15	LED 2 output (active low)
16	Switch 2 input (active high)
17	+5V
18	LED 4 output (active low)
19	Switch 4 input (active high)
20	+5V
21	LED 6 output (active low)
22	Switch 6 input (active high)
23	+5V
24	LED 8 output (active low)
25	Switch 8 input (active high)

CM401T Expansion Port: DB-25 Female pinout

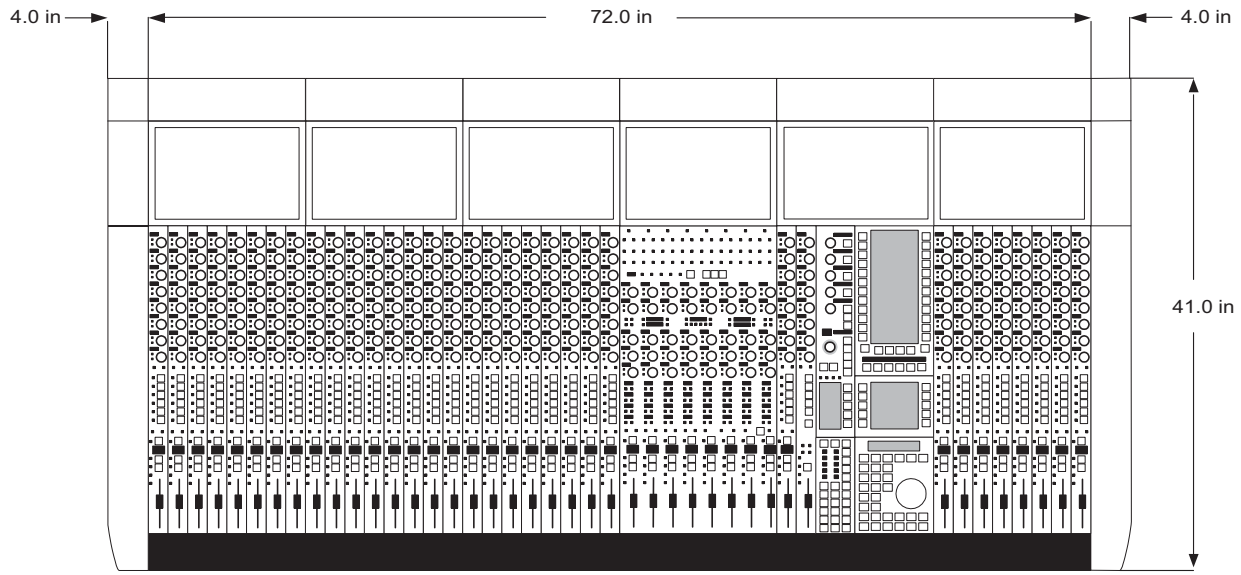
Function	Switch	Talley
Talkback to Mon A (SLS)	Switch 1 (pin 2)	LED 1 (pin 1)
Talkback to Mon B (Cue 1)	Switch 2 (pin 16)	LED 2 (pin 15)
Talkback to Mon C (Cue 2)	Switch 3 (pin 5)	LED 3 (pin 4)
Talkback to Mon D (Cue 3)	Switch 4 (pin 19)	LED 4 (pin 18)



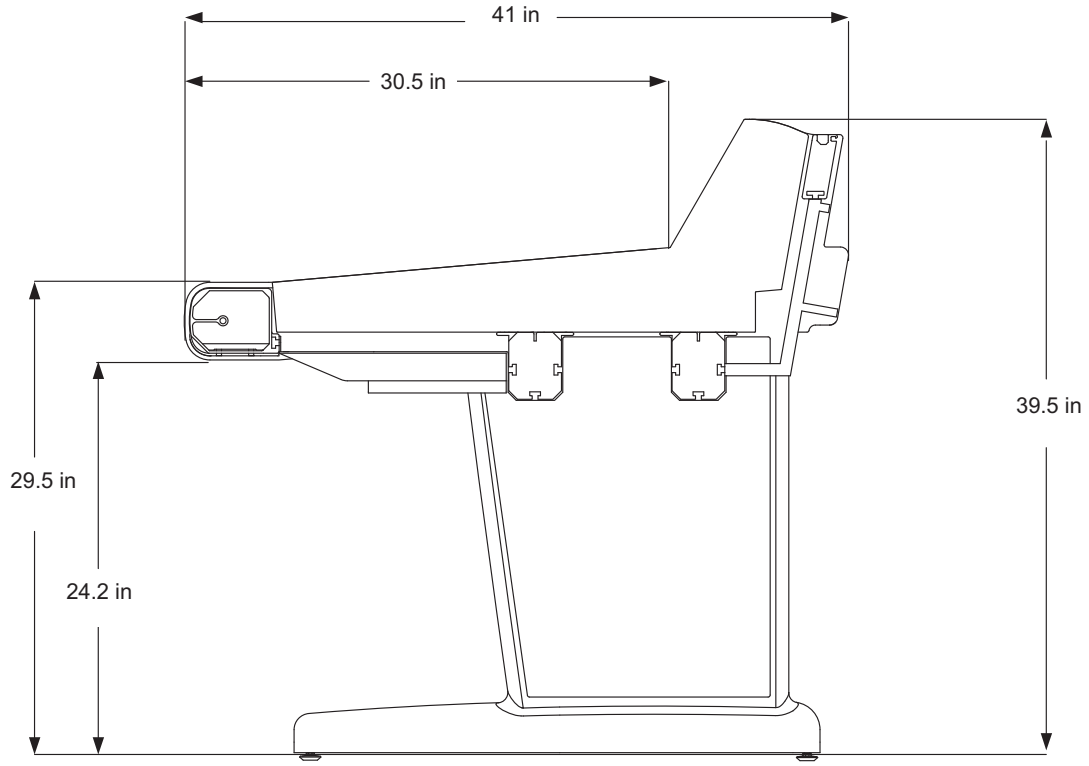
Function	Switch	Talley
Talkback to Mon A (SLS)	Switch 1 (pin 2)	LED 1 (pin 1)
Talkback to Mon B (Cue 1)	Switch 2 (pin 16)	LED 2 (pin 15)
Talkback to Mon C (Cue 2)	Switch 3 (pin 5)	LED 3 (pin 4)
Talkback to Mon D (Cue 3)	Switch 4 (pin 19)	LED 4 (pin 18)

Typical talkback wiring (top) and switch function table (bottom)

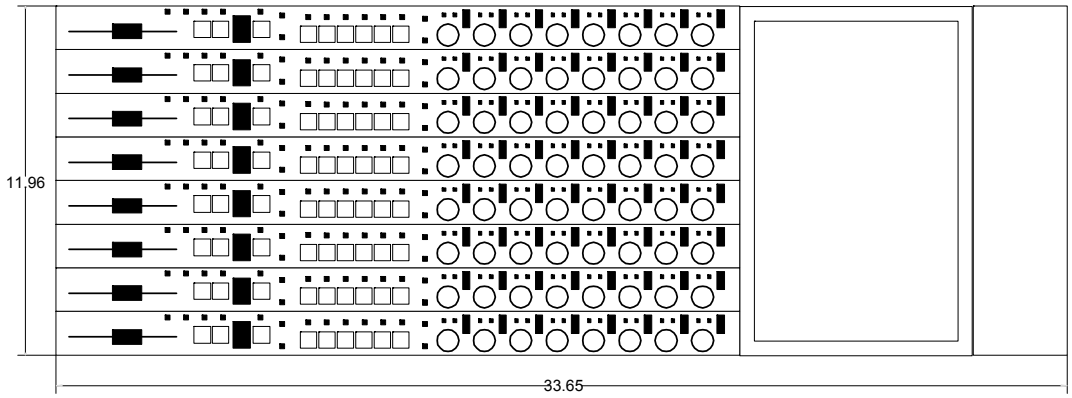
Console Dimensions



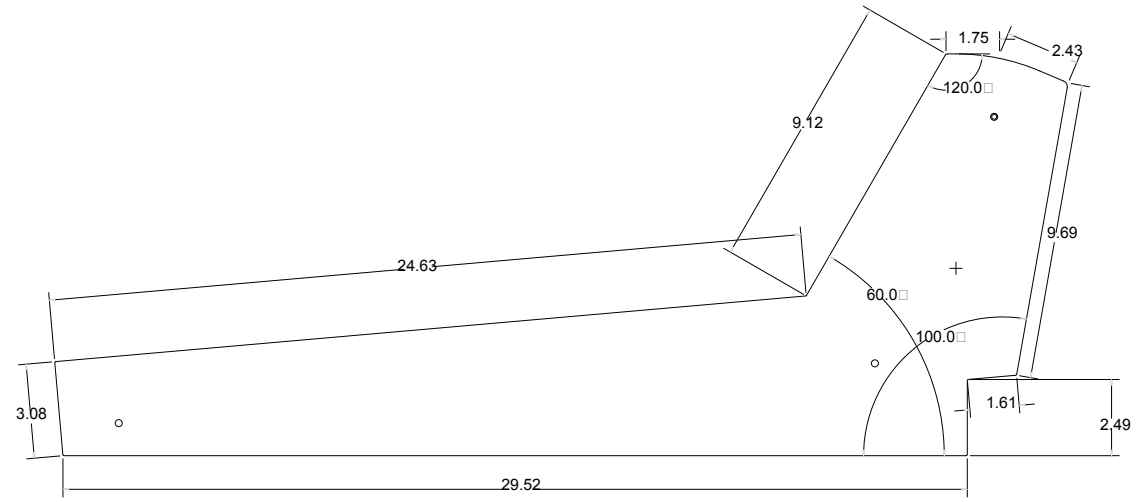
System 5 Console top dimensions



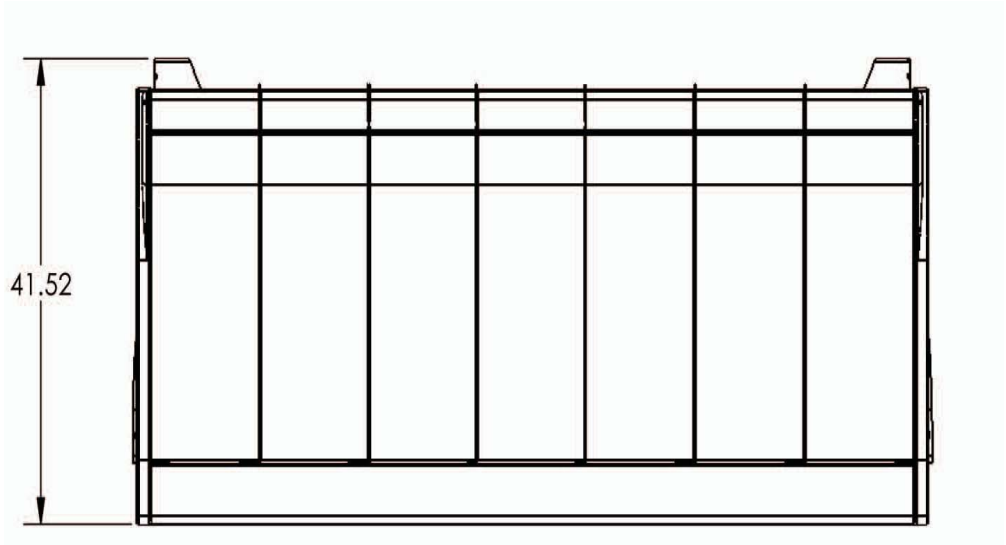
System 5 Console side dimensions



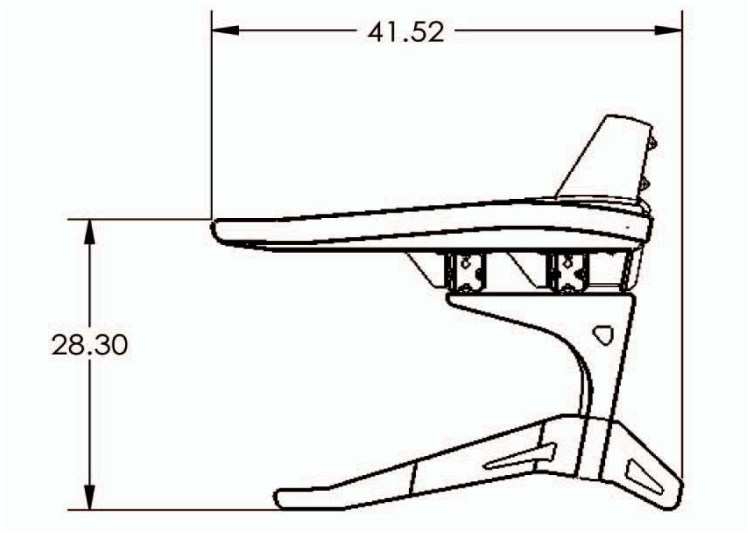
CM40X module top dimensions (inches)



CM40X module side dimensions (inches)



System 5MC top console depth (inches)



System 5MC side console dimensions (inches)

Chapter 4: Connecting System Components

This chapter discusses facility power quality issues, shows how to make sync, MADI, and control connections, and lists console and module specifications.

See "Typical Room and Equipment Layout for System 5" on page 28 before planning an installation to learn about suggested equipment locations.

Facility Power Quality Issues

Although a detailed discussion of power quality issues is beyond the scope of this manual, we recommend following the standards and specifications below for reliable performance of your Avid console.

If a product must be operated in a degraded power environment, be careful not to exceed the EN55102 electronic limits.

Harmonic Distortion

IEEE Standard 519: Recommended Practices and Requirements for Harmonic Control In Electrical Power Systems, establishes harmonic limits on voltages for computers and related equipment. AC power sources shall have no more than 5% harmonic voltage distortion, with the largest single harmonic being no more than 3% of the fundamental voltage. Higher levels of harmonics can result in erratic behavior and unpredictable performance.

Voltage Transient

A transient impulse is a sharp, sudden rise in voltage. The power can jump up to several thousand volts, with spikes large enough to damage sensitive electronic equipment. Transient disturbances may also cause computers to reset and/or breakers to trip. Spike durations usually last between 4 ms and 1 cycle (17 ms at 60 Hz) and exceed 50% or greater than the nominal voltage level. System 5's products have been tested and found to comply with the performance limits of EN55103:2, E-4 Environment.

A two-year study by the IEEE of 200 locations found that over 80% of the equipment interruptions were due to power lines transients.

Voltage Fluctuation

Voltage fluctuation is a sudden and noticeable change in RMS voltage level, usually caused by variable system loads. Certain types of electronic equipment are more susceptible to voltage fluctuations than others. *Flicker*, or *light flicker,* is voltage fluctuation with a typical duration of 3–10 cycles (50–167 ms at 60 Hz). System 5's products have been tested and found to comply with the performance limits of EN55103:2, E-4 Environment.

Voltage Sag

A voltage sag is a brief dip in voltage below 90% of the equipment rating. System 5's products have been tested and found to comply with the performance limits of EN55103:2, E-4 Environment.

Grounding

The main service entrance should contain the only neutral-ground bond, except in the case of a separately derived system, such as an isolation transformer. Avid recommends that the neutral-to-ground voltage in a 120 V, single-phase system be less than 3 V RMS. In high-availability systems, a neutral-to-ground voltage above 0.5 V has been identified as a possible source of disturbances. Ground leakage currents should be 0.0035 A or less.

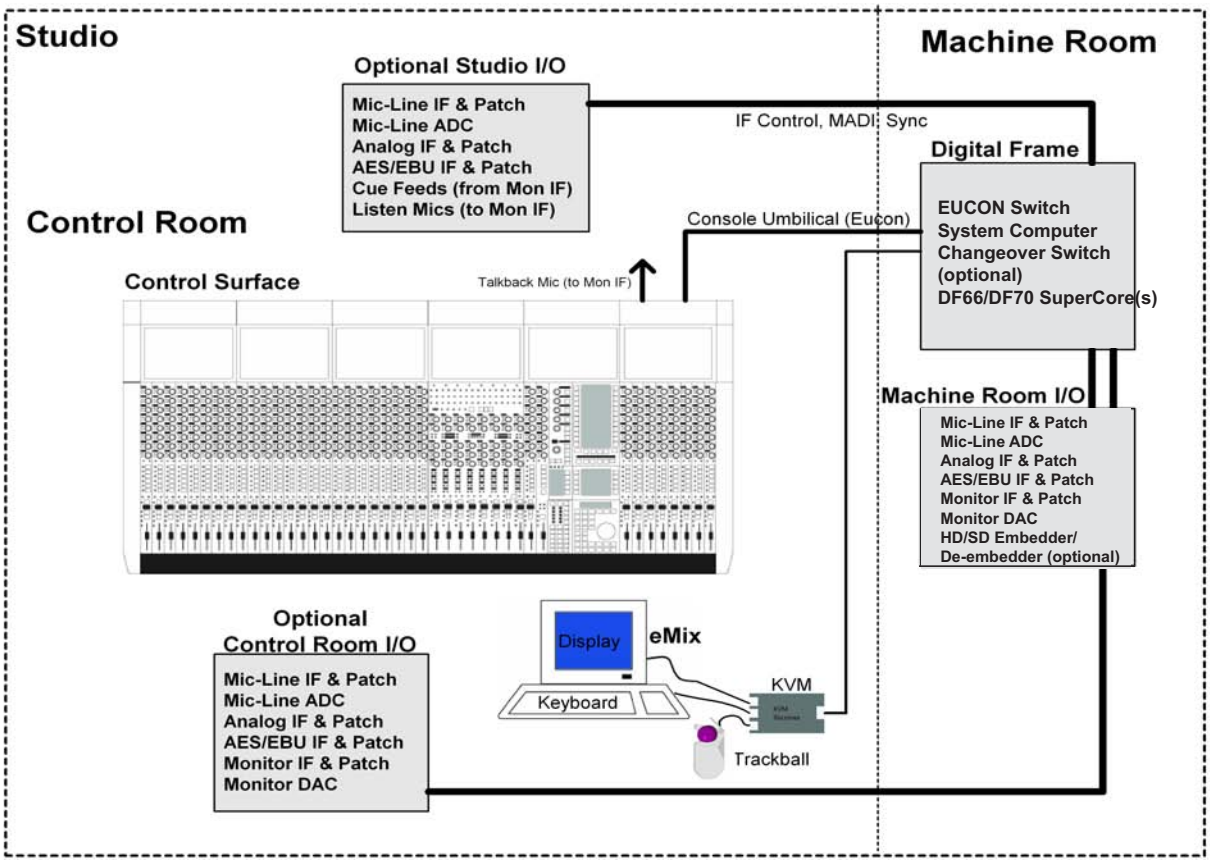
Ground resistance is due to the resistivity of the soil in the vicinity of the grounding electrode. Most computer manufacturers recommend a maximum ground resistance of 2 Ω.

Uninterruptible Power Supply (UPS)

UPS devices provide continuous power, even when utility supply power is interrupted or lost. Since the power on an on-line UPS flows through a rectifier and inverter before reaching the load, most power disturbances are eliminated through constant filtering. Therefore, an on-line UPS is a good idea for all high-availability systems operated in environments that cannot guarantee high-quality power. Most UPS devices have a voltage regulator to compensate for the voltage variances described above.

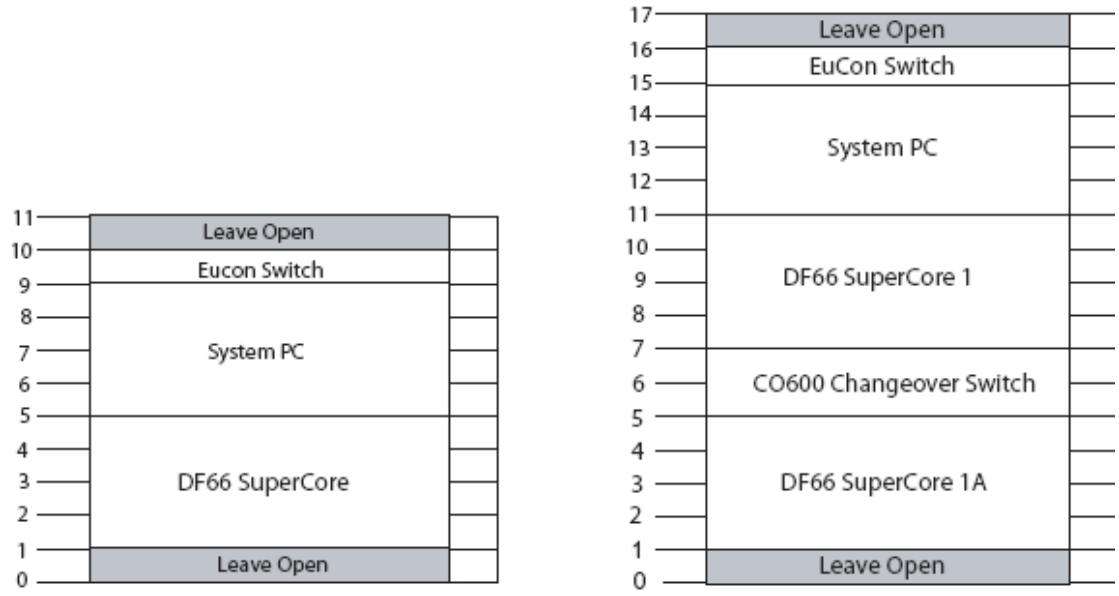
⚠ *If it is determined that your facility is below standard in any of the specifications described above, we recommend contacting an experienced electrician (or engineering consultant for large facilities) with expertise in power quality issues.*

Typical Room and Equipment Layout



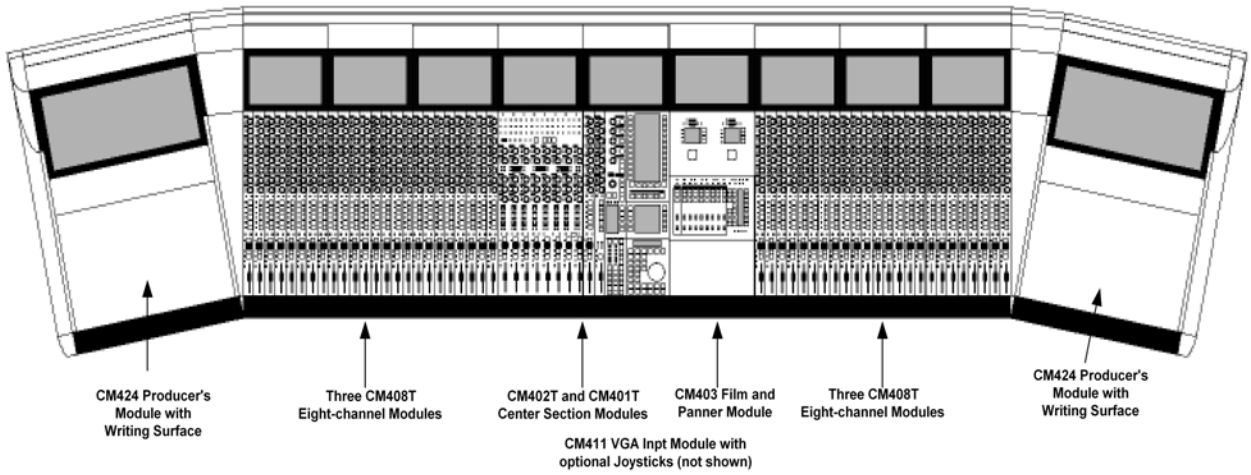
Typical Room and Equipment Layout for System 5

Rack Elevations



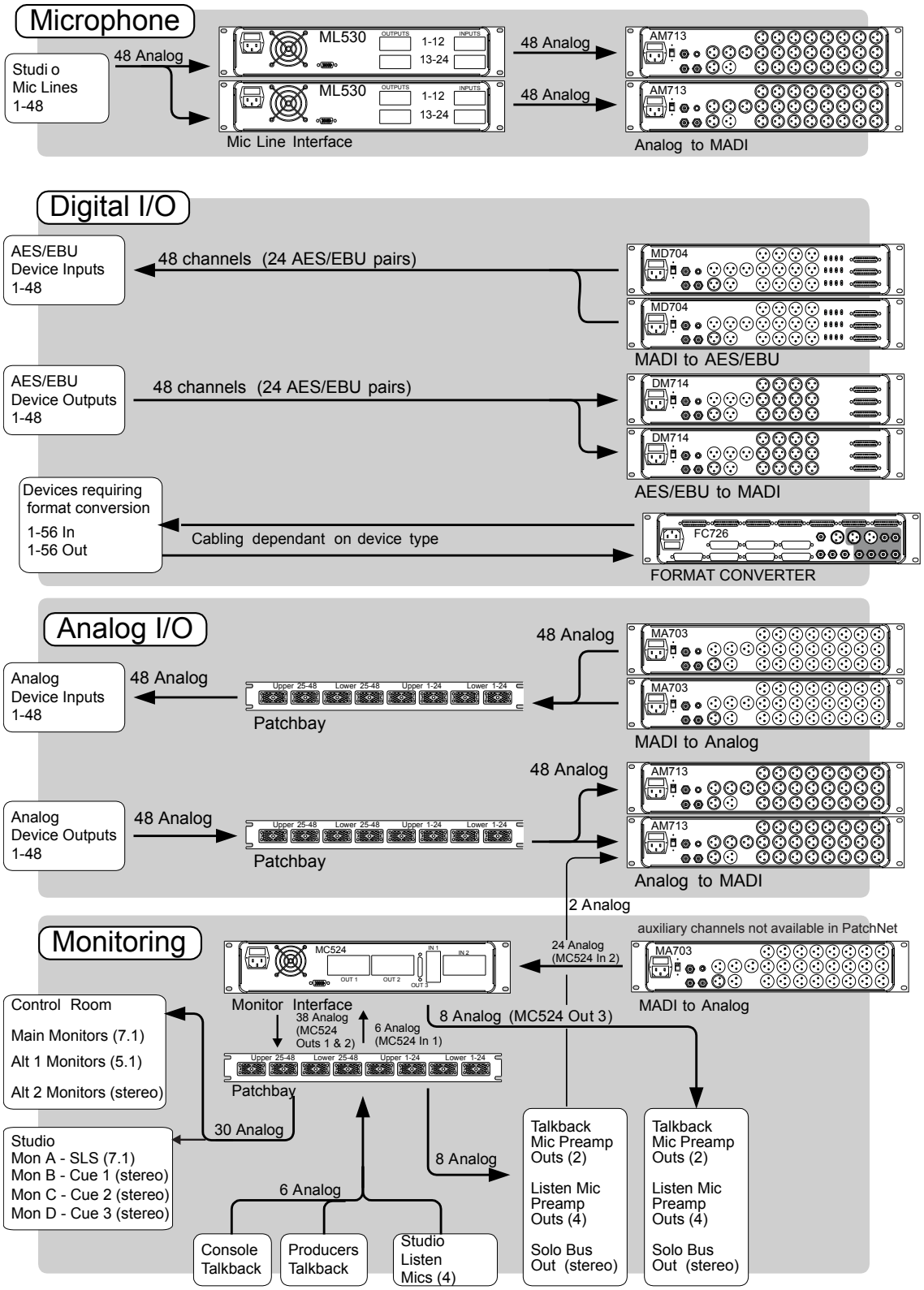
Single and redundant core systems with rack specifications

Typical Console Layout



System 5 Console

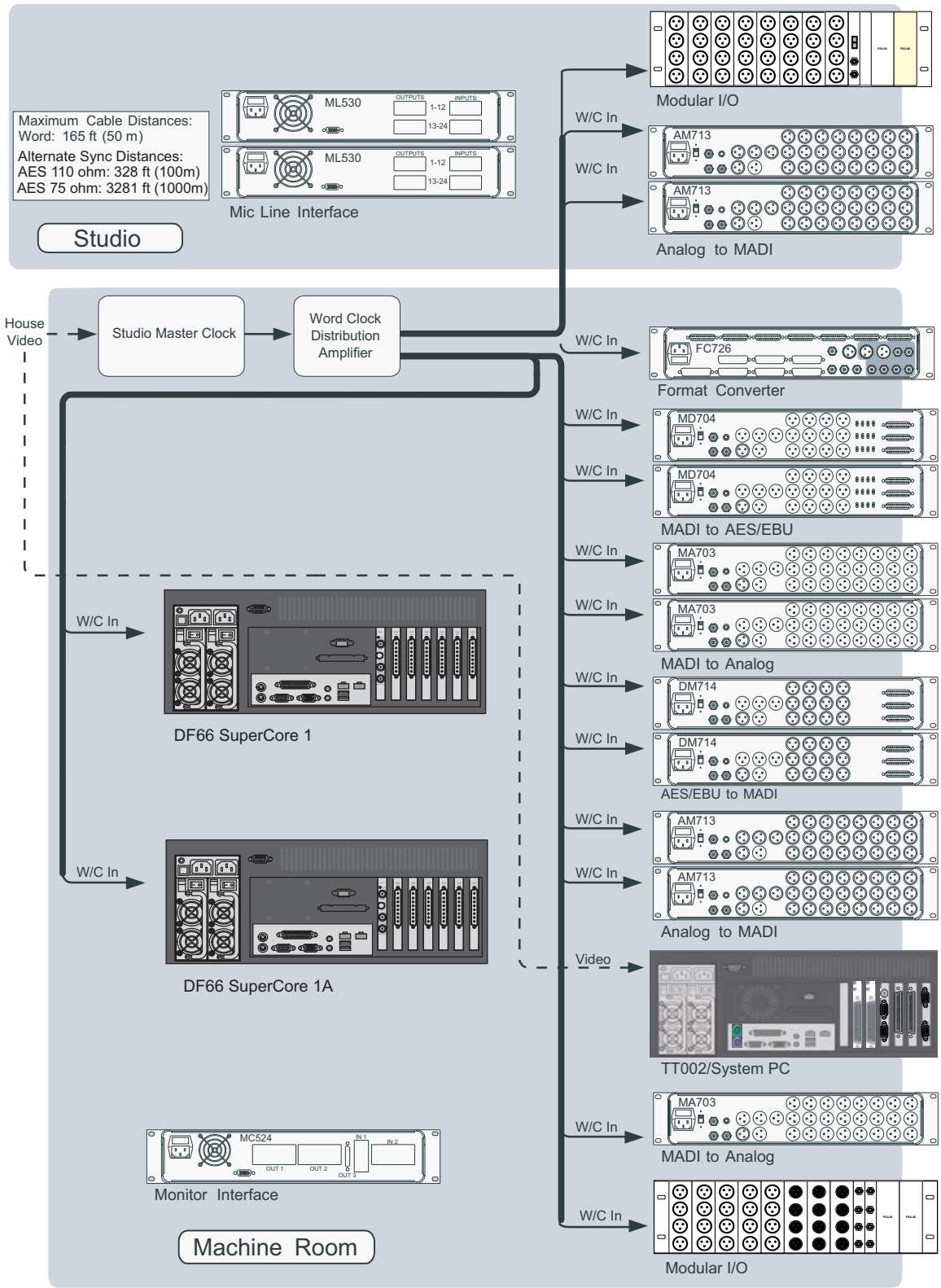
Audio Connections



Audio connections

The MA703, MD704, AM713, and DM714 converters have extra pairs of auxiliary AES/EBU and analog channels available.

Synchronization Connections



Synchronization connections

Synchronization Issues

It is important to avoid, or at least minimize, timing differences between signal paths so timing errors do not pose an audible problem. It is good practice to send sync signals to all system components from one source. Feed each distribution amplifier directly from the master clock source, and do not loop sync signals. The following guidelines illustrate correct sync distribution.

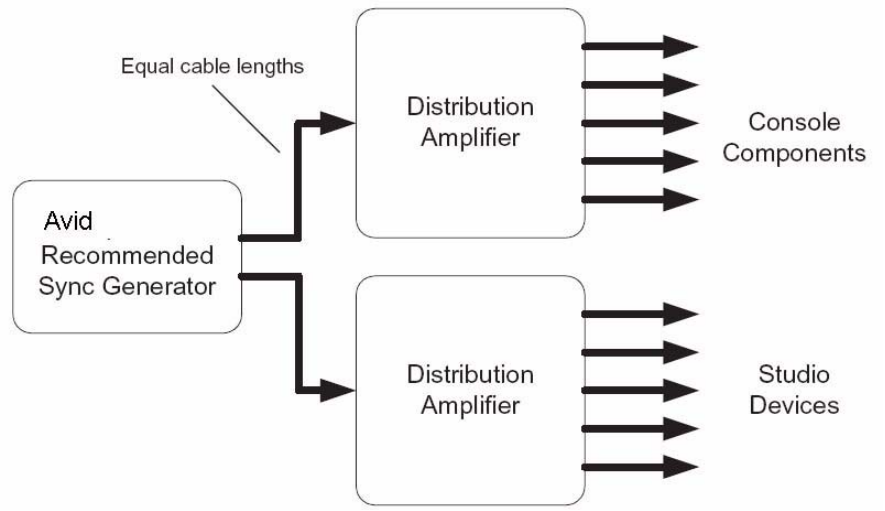
Word clock or AES/EBU sync may be used, but word clock has lower cabling and labor costs.

Studios with an Existing Digital Master Clock and Sync Distribution

- Clock jitter should be less than 0.025 UI (AES3-1992 (r1997)).
- Each system component requires one additional D/A output.
- Use equal cable lengths from the master clock to the distribution amps (AES11-1997, 5.4).

Studios Without an Existing Digital Master Clock

- Use one of Avid's recommended sync generators (see next page), which may be set to internal or gen-locked to a video reference.
- Use one of Avid's recommended distribution amps (see next page) to directly feed all system components and studio devices.
- Use equal cable lengths from the master clock to the distribution amps (AES11-1997, 5.4).



Correct synchronization distribution

System 5 Components Requiring Digital Sync

- DF66 and DF70 DSP Cores
- AM713 Analog to MADI Converters
- MA703 MADI to Analog Converters
- DM714 AES to MADI Converters
- MD704 MADI to AES Converters
- FC726 Format Converters
- Modular I/O

Recommended Digital Sync Generators

Lucid

- SSG192: Greatest number of features, most user friendly

NVision

- SG4410: Convenient modular design, no pull up/down rates

Apogee

- Big Ben: Convenient modular design, six word clock outputs

Recommended Sync Distribution Amplifiers

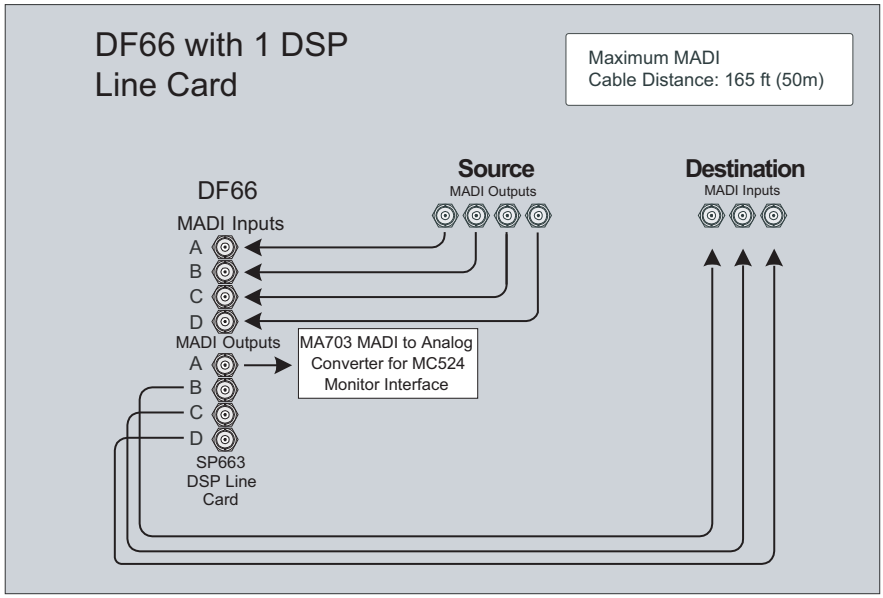
NVision

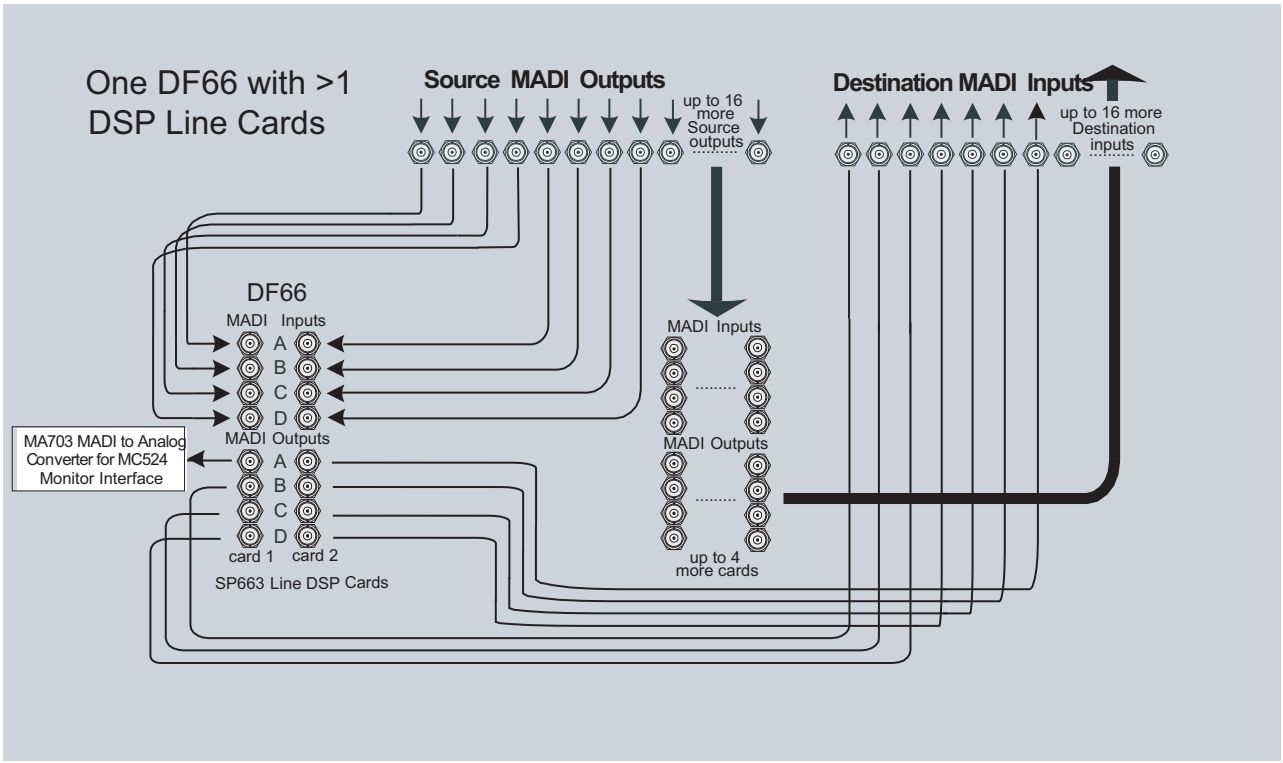
- DA4010: AES/EBU
- DA4023: Word Clock (48 kHz only)

Lucid

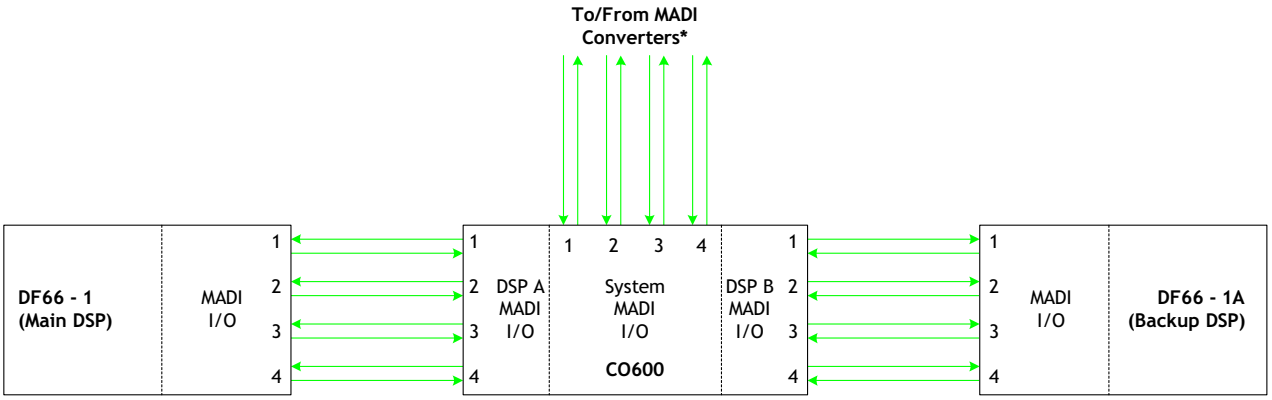
- AESx4 AES/EBU
- CLKx6 Word Clock

MADI Connections





MADI connections: 1 DF66, 1 DSP line card (top); 1 DF66 with > 1 DSP line cards (bottom)



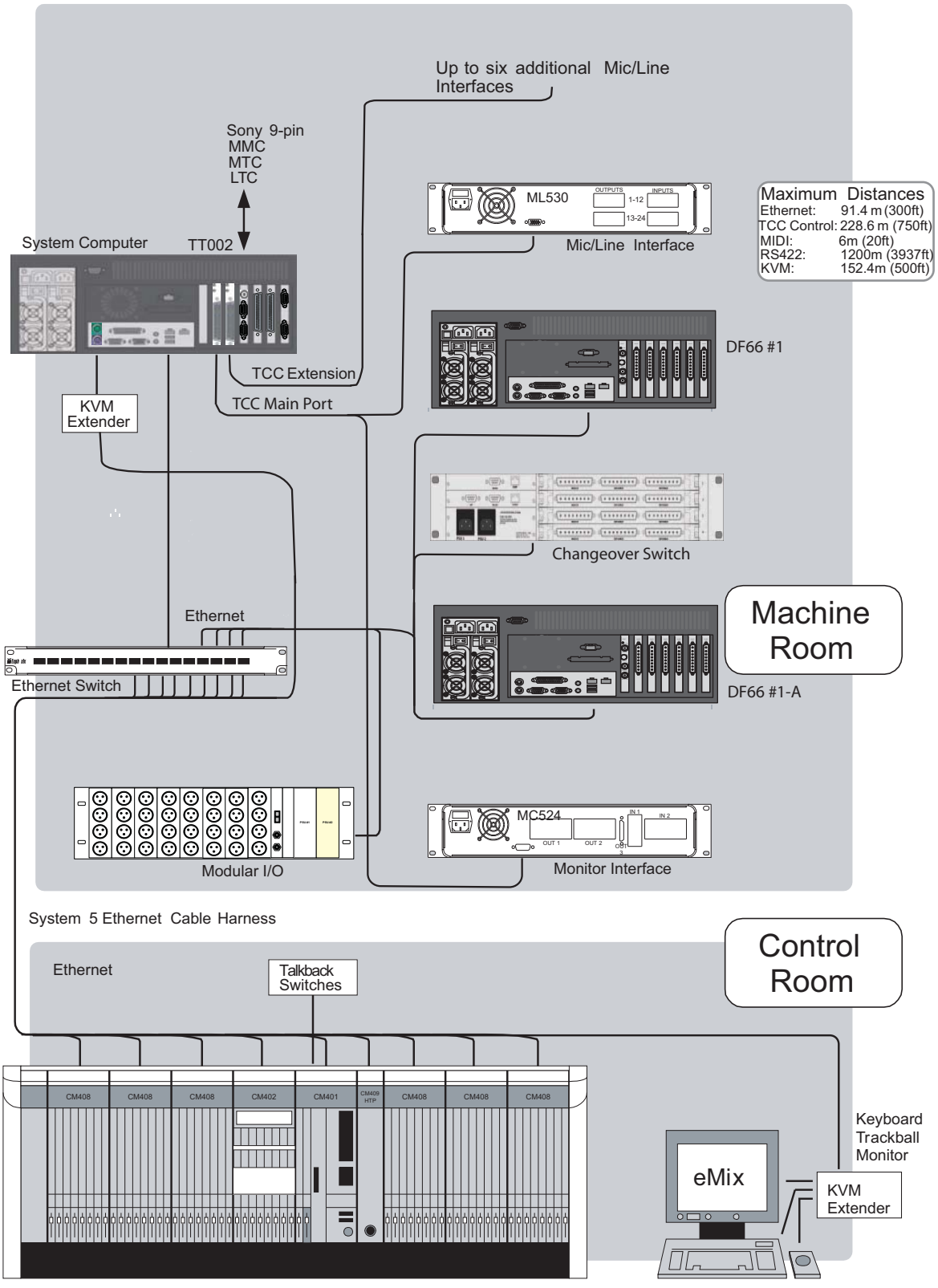
- Each Green interconnect line represents four (4) MADI connections.
- A single CO600 can hold four (4) CO601 Changeover cards.
- Each CO601 is capable of handling 4 In, 4 Out MADI connections from and to input/output converters. It distributes/switches these inputs/outputs to and from each DF66 DSP core.
- Interconnections between CO600 and DF66 are made using Avid-supplied cabling.
- Input and output from the CO600 is provided by Euphonix-supplied cabling, terminating to BNC "Bulkhead" panels.
- Above Configuration shows a total of 16 MADI connections in and out of the CO600/DSP

*) Output Port 1, MADI connection #1 is reserved for the MA703/MC524 monitoring output

MADI connections: primary DF66 SuperCore, CO660 Changeover Switch, backup DF66 SuperCore

System designers, integrators, and end users are responsible for choosing cables, terminations, and equalizations that conform to the recommended practice. Although the maximum recommended distances over copper can be exceeded by using high performance cables, Avid does not endorse a particular brand or method of achieving the end result.

Control Connections



Control connections

System 5 Console and Module Specifications

The following table summarizes important specifications for System 5 components.

System 5 Console and Module Specifications

Component	Height	Width	Depth	Weight	Power Consumption	Heat Dissipation
CM401T Master Module	13.25" 34 cm	12" 30 cm	33.5" 84 cm	35 lb 16 kg	250 W	853 BTU/hr
CM402T Expanded Channel Module	13.25" 34 cm	12" 30 cm	33.5" 84 cm	35 lb 16 kg	250 W	853 BTU/hr
CM403 Film/Post Module	13.25" 34 cm	12" 30 cm	33.5" 84 cm	35 lb 16 kg	120 W	450 BTU/hr
CM408T Eight Channel Module	13.25" 34 cm	12" 30 cm	33.5" 84 cm	35 lb 16 kg	250 W	853 BTU/hr
CM409F	13.25" 34 cm	12" 30 cm	33.5" 84 cm	16 lb 7 kg	–	–
CM409H	13.25" 34 cm	6" 15 cm	33.5" 84 cm	9 lb 4 kg	–	–
CM409HTP Track Panner Module	13.25" 34 cm	6" 15 cm	33.5" 84 cm	10 lb 4.5 kg	–	–
CM411 VGA Input Module	13.25" 34 cm	12" 30 cm	33.5" 84 cm	18 lb 8.2 kg	35 W	410 BTU/hr
CM424 Producer's Module with Writing Surface	13.25" 34 cm	24" 60 cm	33.5" 84 cm	35 lb/16 kg (50.5 lb/22.9 kg with display)	150 W with display	512 BTU/hr with display
Console Frame 6 ft	39.5" 1 m	6'10" 2.08 m	41" 1.04 m	245 lb 111 kg	–	–
Console Frame 9 ft	39.5" 1 m	9'10" 3 m	41" 1.04 m	300 lb 136 kg	–	–
Console Frame 12 ft	39.5" 1 m	12'10" 3.9 m	41" 1.04 m	380 lb 172 kg	–	–
S5MC Frame 5 ft	38.4" 0.975 m	5'5" 1.64 m	41.5" 1.05 m	270 lb 122.5 kg	–	–
S5MC Frame 7 ft	38.4" 0.975 m	7'5" 2.25 m	41.5" 1.05 m	326 lb 147.9 kg	–	–
S5MC Frame 9 ft	38.4" 0.975 m	9'5" 3 m	41.5" 1.05 m	382 lb 173.3	–	–
MC524 Monitor Interface	3.5" 89 mm 2RU	17"/432 mm (19"/483 mm faceplate)	18.5" 470 mm	17 lb 7.7 kg	70 W	240 BTU/hr
ML530 Mic-Line Interface	3.5" 89 mm 2RU	17"/432 mm (19"/483 mm faceplate)	18.5" 470 mm	17 lb 7.7 kg	100 W	345 BTU/hr
SC264 System Computer	7" 177 mm 4RU	19" 483 mm	19" 483 mm	44 lb 20 kg	200 W	685 BTU/hr
DF66 Digital Frame	7" 177 mm 4RU	19" 483 mm	19" 483 mm	44 lb 20 kg	500 W	1025 BTU/hr

System 5 Console and Module Specifications

DF70 **Digital Frame**	8.75" 222 mm	19" 482 mm	26" 660 mm	79.3 lb 36 kg	400 W	1400 BTU/hr
C0600 **Changeover Switch**	3.5” 89 mm 2RU	17”432 mm (19”/483 mm faceplate)	11.7” 296 mm	18.7 lb 8.5 kg	100 W	345 BTU/hr
AM713 **Analog to MADI Converter**	3.5” 89 mm 2RU	17”/432 mm (19”/483 mm faceplate)	18.5” 470 mm	17 lb 7.7 kg	50 W	175 BTU/hr
MA703 **MADI to Analog Converter**	3.5” 89 mm 2RU	17”/432 mm (19”/483 mm faceplate)	18.5” 470 mm	17 lb 7.7 kg	50 W	175 BTU/hr
DM714 **AES/EBU to MADI Converter**	3.5” 89 mm 2RU	17”/432 mm (19”/483 mm faceplate)	18.5” 470 mm	17 lb 7.7 kg	25 W	90 BTU/hr
MD704 **MADI to AES/EBU Converter**	3.5” 89 mm 2RU	17”/432 mm (19”/483 mm faceplate)	18.5” 470 mm	17 lb 7.7 kg	25 W	90 BTU/hr
FC726 **Digital Format Converter**	3.5” 89 mm 2RU	17”/432 mm (19”/483 mm faceplate)	18.5” 470 mm	13.5 lb 6 kg	50 W	175 BTU/hr
Modular I/O **Configuration System**	5.25” 133.5 mm	17”/432 mm (19”/483 mm faceplate)	18.5” 470 mm	~12 lb ~5.3 kg	80 W	275 BTU/hr

Appendix A: Compliance Information

Environmental Compliance

Disposal of Waste Equipment by Users in the European Union

This symbol on the product or its packaging indicates that this product must not be disposed of with other waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city recycling office or the dealer from whom you purchased the product.

Proposition 65 Warning

⚠ *This product contains chemicals, including lead, known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling.*

Perchlorate Notice

This product may contain a lithium coin battery. The State of California requires the following disclosure statement: “Perchlorate Material – special handling may apply, See www.dtsc.ca.gov/hazardouswaste/perchlorate.”

Recycling Notice

EMC (Electromagnetic Compliance)

Avid declares that this product complies with the following standards regulating emissions and immunity:

- FCC Part 15 Class A
- EN55103-1 E4
- EN55103-2 E4
- AS/NZS CISPR 22 Class A
- CISPR 22 Class A

FCC Compliance for United States

Communication Statement
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Any modifications to the unit, unless expressly approved by Avid, could void the user's authority to operate the equipment.

Australian Compliance

Canadian Compliance

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le material brouilleur du Canada.

CE Compliance

(EMC and Safety)

Avid is authorized to apply the CE (Conformité Européenne) mark on this compliant equipment thereby declaring conformity to EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC.

Safety Compliance

Safety Statement

This equipment has been tested to comply with USA and Canadian safety certification in accordance with the specifications of UL Standards: UL60950-1:2007, 2nd Ed and CAN/CSA C22.2 No. 60950-1-07, 2nd Ed. Avid Technology Inc., has been authorized to apply the appropriate NRTL mark on its compliant equipment.

Warning

Important Safety Instructions

1) Read these instructions.

2) Keep these instructions.

3) Heed all warnings.

4) Follow all instructions.

5) Do not use this equipment near water.

6) Clean only with dry cloth.

7) Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.

8) Do not install near any heat sources such as radiators, heat registers, stoves, or other equipment (including amplifiers) that produce heat.

9) Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

10) Protect power cords from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the equipment.

11) Only use attachments/accessories specified by the manufacturer.

12) For products that are not rack-mountable: Use only with a cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the equipment. When a cart is used, use caution when moving the cart/equipment combination to avoid injury from tip-over.

13) Unplug this equipment during lightning storms or when unused for long periods of time.

14) Refer all servicing to qualified service personnel. Servicing is required when the equipment has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the equipment, the equipment has been exposed to rain or moisture, does not operate normally, or has been dropped.

15) For products that are a Mains powered device:
The equipment shall not be exposed to dripping or splashing and no objects filled with liquids (such as vases) shall be placed on the equipment.

Warning! To reduce the risk of fire or electric shock, do not expose this equipment to rain or moisture.

16) For products containing a lithium battery:
CAUTION! Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type.

17) For products with a power switch:
It should remain accessible after installation.

18) The equipment shall be used at a maximum ambient temperature of 40° C.

19) This unit is provided with a power supply cord set suitable for 120V AC input only (for U.S.A.and Canada). For other than U.S.A. and Canada, a qualified person must provide for use with this unit, an appropriate, approved power supply cord set which is in compliance with the end use country requirements and has a minimum cross-sectional area of 1.0mm2.

20) For products with more than one power cord:

CAUTION: This unit has more than one power supply cord. Disconnect two power supply cords before servicing to avoid electrical shock.

ATTENTION: Cet appareil comporte plus d'un cordon d'alimentation. Afin de prévenir les chocs électriques, débrancher les deux cordons d'alimentation avant de faire le dépannage.

21) For products with an operator-accessible fuse:

CAUTION: For continued protection against risk of fire, replace only with same type and rating of fuse.

ATTENTION: Pour ne pas compromettre la protection contre les risques d'incendie, remplacer par un fusible de même type et de même caractéristiques nominales.

Avid
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Daly City, CA 94014-3886 USA

Technical Support (USA)
Visit the Online Support Center at
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Product Information
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